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of any great-circle track previously laid down, just as the rhumb course and distance are measured on the Mercator chart. These principles were recognized in the construction of the great-circle charts issued by the Hydrographic Office. The maturing of them, and their publication in the form of the present excellent sailing-charts, have been due to that office. They are now issued for the North and South Atlantic Oceans, and Indian Ocean. The plate for the latter was used to reproduce, by electrotyping, plates for the North and South Pacific Oceans. It is expected that this series of sailing-charts will be completed before July 1, 1889. Those already published have been received with great favor, and have undergone severe tests for accuracy and utility; and numerous reports have been received testifying to their usefulness in lessening the labor of computations on the great-circle route.

The general lack of the practical application of the principles of great-circle sailing in the past seems to have resulted, not from the want of recognition of the fact that the shortest distance between any two points on the earth's surface is the arc of the great circle passing through them, nor that the great-circle course is the only true course, but from the tedious operations which have been necessary, and from the want of concise methods for rendering these benefits readily available.

Sanitation in India.

Mr. B. F. Bonham, United States consul-general at Calcutta, has sent to the State Department an abstract of a lecture by Mr. Justice Cunningham, at the Parkes Museum, on 'Sanitation in India,' from which the following interesting extracts are made:—

"The views of the sanitary parties in India might be summarized in the following proportions: that the mortality of the population is vastly in excess of that of civilized countries, and in particular cannot be calculated at less than 10 to 15 per thousand in excess of the English rates, an excess making at least 2,500,000 of deaths and 50,000,000 cases of severe diseases; that this excess, or a large portion of it, is preventable by practical means fairly within human competence; that the existing administrative machinery is powerless to make any impression on this excessive mortality, but that its tendency is rather to intensify it; that there are reforms which materially affect it, which might be adopted without grievance to the people or detriment to the government finances, and that it is the duty of the government to adopt such reforms. As to the excessive mortality, the lecturer pointed out that wherever registration approached completeness there were high ratios of 30 per thousand and more, the central provinces ratio being 34 and the north-western provinces 32; that many large areas with populations of a million and upwards showed ratios of 40 and 50 per thousand, and many towns and municipalities showed ratios of 40, 60, 70, 80, and even higher. Such ratios showed that the laws of health were being contravened on an enormous scale. A curious instance of the extreme prevalence of disease was shown in Calcutta, where, out of a population of 445,000 persons, no less than 325,000 were treated annually in public medical institutions. Coming next to preventability, experience proved, that, wherever effective sanitation was carried out, the ratios of Indian mortality sunk at once to that of England.

"The great mass of Indian mortality was occasioned by epidemic diseases, which are preventable or mitigable, and in England have either disappeared or sunk to insignificant proportions. The Army Sanitary Commission gave what they call a 'deplorable record' of 38,000,000 of victims within a single decade to such diseases. Coming to particular instances, the extraordinary reduction in the mortality of the European army from 69 per thousand to 12 or 14, and the invaliding ratio from 43 to 23, the cholera mortality from 9.24 to 1.17, showed what sanitation could do in the case of men newly exposed to a tropical climate. The reduction of the mortality in jails was equally remarkable: it is now about one-third of the former rate. In Madras the extraordinarily low ratio of 17.80 per thousand had been attained. The high ratio of over 100 per thousand in some Bengal jails pointed to active insanitary conditions of soil, structure, or mismanagement. Another striking instance is that afforded by those parts of Calcutta which have been properly sanitated, which would compare favorably with the best parts of London for healthiness, while the insanitary wards of the city are

scoured with epidemics, — are the perennial home of cholera, — and the suburbs of Calcutta have long been a scandal, not only to the Bengal Government, but to English civilization."

BOOK-REVIEWS.

A Text-Book of Physiology. By JOHN GRAY M'KENDRICK. Including Histology, by Philip Stöhr. In two volumes. Vol. I. General Physiology. New York, Macmillan. 8°. \$4.

THE book before us, which is but the first volume of M'Kendrick's 'Text-Book of Physiology,' is modelled to some extent on his 'Outlines of Physiology,' although it has been so greatly extended in every direction as to make it an entirely new book. This volume treats of the general physiology of the tissues; while the second, not yet published, but in the printer's hands, deals with the special physiology of organs.

In the introductory section the author discusses the nature and objects of physiology, matter and energy, and the general principles of biology, including the organic form and mode of growth, the evolutionary history of living beings, and the theories of life. In the second section the chemistry of the body is treated; the nature and properties of the chemical substances found in the body, and the nature of the chemical re-actions with which the phenomena of life are associated, being considered fully. The true value which should be given to chemical formulæ by the physiological student is specially explained by the author. The chapter on pigments is an exceedingly valuable one, the subject being treated more fully than in any other text-book of physiology.

Dr. M'Kendrick has been especially fortunate in being able to incorporate into his text-book Professor Stöhr's 'Lehrbuch der Histologie,' which, so far as we know, had not, up to this time, been translated. The illustrations of this portion of the work are not diagrams, but drawings of real preparations, and remarkably true to nature.

The closing section treats of the contractile tissues. In it the electrical apparatus employed in the study of muscle is described and illustrated. The author believes, and we think rightly, that the importance of the uses of electricity in practical medicine and surgery justifies him in describing electrical apparatus. We are somewhat surprised to find the statement that "the teacher has usually to deal with students who know little or nothing about physics." We had supposed that the student, before being permitted to begin the study of medicine in the United Kingdom, must be well prepared in physics, and are therefore surprised to hear one who is undoubtedly in a position to know, say that he knows "little or nothing" about it. It appears, however, from our author's preface, that an examination in mechanics is required as a preliminary; but this, he says, is of no use, being just sufficient to worry the student and exhaust his energies, without conferring any real benefit in the shape of a knowledge of the principles of physical science. It is on account of this ignorance on the part of students that certain details as to physics are introduced into this text-book. Taken as a whole, the first volume of Dr. M'Kendrick's book is a most valuable one, and we shall look for the second with great interest. If he succeeds as well in his treatment of special as he has succeeded with general physiology, his text-book will be entitled to a prominent place among the best text-books of physiology.

Electrical Instrument Making for Amateurs. By S. R. BOTTONE. 2d ed. New York, Van Nostrand. \$1.20.

IN the preface to this work Mr. Bottone says, "Nearly all the really useful inventions and discoveries which have rendered the nineteenth century so remarkable as a season of progress must be attributed to amateurs. For this reason, if for no other, we should render every assistance in our power to the *bona fide* amateur." Mr. Bottone's idea of a *bona fide* amateur is difficult to conceive. He would claim a wide meaning for the word if he included Faraday, Maxwell, Joule, Thomson, and Rayleigh, in his own country. Still there is no need of quarrelling about a definition, or of asking by whom the useful work of this century has been done. Mr. Bottone's book is a helpful and a needed one, and has much to com-

mend it. It appeals to 'true amateurs,'—boys who have a scientific turn of mind, and men who have some leisure from their work, but who have not the facilities that a laboratory offers.

The tools required are of the simplest kind, no turning-lathe or expensive apparatus being needed. Most of them are to be found in the ordinary equipment of a householder: the rest may be purchased for a few dollars. The materials, too, are inexpensive and easy to get.

The directions in this book are full and clear, and where it is necessary dimensional drawings are given. When the amateur has built every thing that is described, he will find himself in possession of quite a complete set of apparatus for electrical experiments, — galvanometers, electroscope, condenser, voltmeter, Wimhurst machine, induction-coil, etc.; and, if he compares the cost of them with the catalogue prices, he will have cause to congratulate himself. But the most important thing he has acquired is a skill in manipulation, and a knowledge of the instruments that will enable him to experiment usefully with them.

There are some verbal errors in the book, — we do not usually speak of "8 hours' resistance," for example, — but they do not take away its usefulness. In that part of the appendix, however, that treats of accumulators, there is the serious mistake of confusing discharge-rate with storage-capacity. Page 174 had better be omitted.

Popular Chemistry. By J. DORMAN STEELE. New York, Barnes. 16°.

THIS is the familiar 'Fourteen Weeks in Chemistry,' revised and brought down to date, with some additions in appendices describing methods of manipulation and simple analyses. The object of this successful book was, by bringing out prominently such elementary facts in chemistry as would be likely to interest the average boy or girl, to give the most of them such a smattering of knowledge as would give a key to many of the chemical changes they would be likely to observe in every-day life, and to leave such a pleasant impression with the few as might lead them to further study. The book has served its purpose well in the past, and, in its new form, is likely to have a continued usefulness for some time to come. The revision has been done by competent hands. A useful glossary, giving the pronunciation of chemical terms, is one of the additions. The chapters on organic chemistry have been completely re-arranged and to a great extent re-written.

An Index to Engineering Periodicals, 1883 to 1887 inclusive.

By FRANCIS E. GALLOUPE, M.E. Boston, 30 Kilby Street; New York, Eng. News Publ. Co. 294 p. 12°.

THE progress in developing material resources, in recent years, has created a vast amount of engineering literature, which is scattered through the various engineering journals. To render a large amount of this available, has been Mr. Galloupe's task, who has sought, in a handy little volume containing about ten thousand references, to cover the contents of the leading journals during the past five years. The matter seems to be arranged admirably under topics. The book will certainly serve a purpose with all interested.

NOTES AND NEWS.

MR. G. W. LITTLEHALES, assistant in the Hydrographic Office, has completed a monograph on 'Recent Developments in Great Circle Sailing.' Lieutenant Dyer, in charge of the office, who has devoted much time and labor to the study of this subject, will write the preface. — Henry Holt & Co. announce as in preparation, 'Briefer Course in Physics,' by George F. Barker; 'Dissection of the Dog,' as a basis for the study of physiology, by W. H. Howell; 'Brief History of the United States,' by Alexander Johnston, professor in Princeton College (this book is intended to meet the needs of teachers who desire a briefer and more elementary text-book than the author's well-known 'History of the United States'; it is, however, very far from being a condensation of that work); 'Greek Literature,' by Thomas Sergeant Perry; 'Chemistry (Advanced Course),' by Ira Remsen; 'Das Wesentliche der Deutschen Grammatik,' by A. W. Spanhoofd; and 'First Lessons in Political Economy,' by Francis A. Walker. — D. Van Nostrand, New York, announces 'The Elements of Electric Lighting,' by Philip Atkinson, for speedy issue; also 'Modern Reproductive Processes,' being a manual of

instruction in the art of reproducing drawings, engravings, manuscripts, etc., by the action of light, by Mr. Ernst Lietze; a translation of the Russian work of Woeikof on 'The Climates of the Earth,' by Prof. Cleveland Abbe of the Signal Office; a large and important work by Col. George E. Waring, jun., being a general treatise on city, town, and village sewerage and drainage, and land drainage; and 'Plate Girder Construction,' by Isami Hiroi, the latest issue in the Van Nostrand's Science Series. — G. S. Fellows & Co., New York, announce 'Memory Systems, New and Old,' by A. E. Middleton. This is the first American edition from the second English edition, revised and enlarged, with bibliography of mnemonics, 1325–1888, by G. S. Fellows, M.A., of the Washington High School. They also announce 'Protection Echoes from the Capitol,' by Thomas H. McKee, containing twelve hundred aphorisms and leading principles of the protective policy. — Cupples & Hurd have in press a volume on 'Typical New England Elms and Other Trees.' — Harper & Brothers have just ready Walter Besant's 'Fifty Years Ago.' This is an illustrated account of English life, customs, and manners half a century ago, when Queen Victoria ascended her throne. — G. P. Putnam's Sons publish 'The Story of Media, Babylon, and Persia,' including a study of the Zendavesta or religion of Zoroaster from the fall of Nineveh to the Persian war (continued from 'The Story of Assyria'), by Zénaïde A. Ragozin, in their Story of the Nations Series, illustrated with maps and woodcuts; and 'A Sketch of the Germanic Constitution,' from early times to the dissolution of the empire, by Samuel Epes Turner. — Roberts Brothers publish 'Harvard Vespers,' a volume of addresses to Harvard students, by Francis G. Peabody, Phillips Brooks, Edward Everett Hale, Alexander McKenzie, George A. Gordon, and Andrew P. Peabody, delivered during 1886, 1887, and 1888. — James J. Chapman, Washington, D.C., will issue early in September McPherson's 'Hand-book of Politics for 1888.' It will cover the proceedings of the second session of the last Congress (49th), and the first session of the present Congress (50th), and will give the final facts as to every pending public measure. — *Das Centralblatt für Bibliothekswesen* for July contains a remarkable article by J. Gildemeister of Bonn, on the 'Oriental Literature of the Discovery of America,' containing some curious particulars, taken from a Mohammedan work, of the voyage of an Indian ship, which, after driving about in the ocean for eight months, was cast on to the shore of the New World. — For the first time in its history *The Century* will devote a single issue — the forthcoming September number — largely to educational themes. The contributions will include 'The University and the Bible,' by T. T. Munger, a plea for the study of Christian as well as Heathen classics; 'Women Who go to College,' by Arthur Gilman; and 'The Industrial Idea in Education,' by Charles M. Carter. One illustrated paper is on 'College Fraternities,' with pictures of twenty-eight chapter-houses and society-halls at Yale, Harvard, Princeton, and other colleges; and another is on 'Uppingham, an Ancient School worked on Modern Ideas,' with a number of illustrations by Joseph Pennell, and a portrait of the late head master, Edward Thring, who is said to be, since Arnold of Rugby, the most highly esteemed educator of England. There will also be several important short editorial articles and 'open letters' on different branches of the same subject. Other distinctive features of the magazine, the Lincoln history, Siberian papers, fiction, etc., will, however, be retained. — The Washburn and Moen Manufacturing Company of Worcester, Mass., has just published the sixth edition of their 'Pocket Handbook of Copper and Iron Wire in Electric Transmission.' The book contains a summary of information in regard to the telegraph and telephone in addition to that about wires. — Van Antwerp, Bragg, & Co. have just ready 'Eclectic Physical Geography,' containing 30 charts and 151 cuts and diagrams. — G. P. Putnam's Sons will publish immediately an *édition de luxe* of 'The President's Message,' printed in large type, small quarto, with sixteen full-page moral and graphic illustrations from original designs by Thomas Nast; also the Questions of the Day edition of the same, with annotations by R. R. Bowker, which has been delayed for some important additional material. — Cupples, Upham, & Co. will publish shortly a new book by W. H. H. (Adirondack) Murray. It will be descriptive of the north-western side of the American continent. — Funk & Wagnalls have just issued in